

ASCOS trip report

Summer 2008

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This document contains my notes and observations from the ASCOS cruise aboard the Swedish icebreaker Oden. Throughout this document I refer to LAPXM. It should be noted that this is LAP-XM[®], which is a trademark of Vaisala, our CRADA partner. The purpose of this document is to provide a record of what I observed about the instruments I helped deploy. I have a bias towards engineering details and trying to get good data out of instruments for scientists. This bias is reflected in this document. I also took many photos throughout the cruise. These can be made available to those who want documentation of some of the equipment and conditions. This document is laid out in chronological order. Since it is electronic, some notes and comments will be made where appropriate, and will be obviously created after the date.

1. Monday, 28 July 2008, the 212th day of the year. This is the day I left Boulder. I flew from Denver to Newark, then to Oslo, arriving Tuesday morning. There were some delays, but it worked smoothly. Matt had done a fine job finding a hotel, so everything worked well.
2. Wednesday, 30 July 2008, day 213. Matt, Cassie, and I (with many others of our group) flew from Oslo to Longyearbyen, Svalbard. We checked into a hotel made from a converted bunkhouse and spent some time in the town.
 1. We shared rooms and had an interesting time visiting the city.
3. Thursday, 31 July 2008, day 214. We visited town, had a meeting, and were trying to enjoy the last day on land. In the morning, the ship arrived and was able to tie to the dock. Instead of staying another night on shore, plans were made and we were on board ship by 6 PM. We had dinner on the ship, and started life at sea. This was an unexpected sequence, so we did not get to do all we wanted in Longyearbyen. Oden became our new home. Powered up the container and started work.
4. Friday, 1 August 2008, day 215. Still in the Longyearbyen harbor. This was the day of the solar eclipse. We were able to see it, at about 93% coverage of the sun.
 1. MMCR DM computer started to have problems. I think it is a shutdown command that did not get cleared. It would boot, reach a certain point in Windows, then shut down.
 2. Started up GPS units.
 3. Started up S-band radar.
 4. Matt installed the Crossbow on one of the stick crates. This is an obvious place, as it is not on top of a piece of iron. It is pretty closely aligned with the 449 antenna.
5. Saturday, 2 August 2008, day 216. We left Longyearbyen harbor about 1600 UT.
 1. Matt got the radiometers working, both the MWR (mailbox) and the 60 GHz on the seventh deck. Also, the Italian lidar on seventh deck.
 2. Matt did a calibration on the Crossbow, with help from the ship's crew, which made the correct circles with the ship.
 3. After a phone call to Duane, Matt helped me change out the disk on the DM computer. Now we are running a down-rev version of the Radar Monitor, but now the MMCR works.
 4. I modified the configuration file for the MMCR to output POP spectra, so we can observe the data in near real-time using LAPXM console. Daily calibrations are turned off. This is

the configuration file ASCOS_NoCalSPC_V2.cfg.

5. I installed .net on the MMCR-radar computer. Now it is able to run Dave Carter's GPS program. I installed this program, and will run it automatically on login. It is running and saving location, speed over ground, course over ground, and other important parameters. It is also setting the time on the MMCR-radar computer.
6. Sunday, 3 August 2008, day 216. This is the first intensive observation period of ASCOS. Everything is running. The equipment on the seventh deck is having problems because of power issues. After a couple of more days, the power got straightened out. It was a ship's wiring issue, and experiment issue.
7. Monday, 4 August 2008, day 217. We continue moving north.
 1. After getting clarification by email from Jim Jordan, we started up the 449 Lapxm recording noise, so that the Crossbow data will be saved. It turns out the Crossbow is not a stand-alone instrument, but only records during the dwells of the 449 radar. This is in contradiction to the documentation on the 449 computer.
 2. We started getting "Delayed write errors" on the MMCR-DM computer. We think they are related to the USB drives and copying of data. Emails to Boulder were of no help, and we assume that these errors are not significant and can be ignored.
 3. I got a time synchronization function working on the MMCR-DM computer. I did not get it scheduled to run. It is a basic batch file that can be run and set the DM computer to the same time as the MMCR-radar computer, which is set by GPS.
8. Tuesday, 5 August 2008, day 218. Finished up the IOP at the Marginal Ice Zone. After lunch we started moving north again. Ship moved to UT time for the entire ship.
 1. Received email from Jim about the Crossbow. I stopped it to make sure it is in the angle mode. From what I can tell, it was already in angle mode already.
 2. Just after lunch S-band went off. I don't know what kicked it off, but I had to restart it. Lost about 30 minutes of data. Last record was 11:43:35. Don't know why it stopped.
 3. Worked on MMCR-DM computer with UPS. It has been disabled in the MMCR Radar Monitor. It is a FER1.4KVA unit. This particular unit is not in the tables of the manuals we have. I worked on the UPS with Hyperterminal, and recorded the entire sessions, so there is a good description of what we have and how it is set up.
 4. I changed the UPS to UT time.
 5. In the log, I found the errors that are giving us problems. First a line fault occurs for some unknown reason. Then when it goes to inverter, it almost immediately gets a Low Runtime alarm, which causes the shutdown. Test results from April show an estimated runtime of 7 minutes, while the Low Runtime set point is 9 minutes.
 6. Looking at the manual, the normal battery AmpHour (AH) setting for the 1.4 kVA units is 75. Ours is set to 33. Of course, our exact model number is not in the table. This is supposed to be the total AmpHours of the battery set in the UPS.
 7. In the normal testing, the battery test is not done. I turned the MMCR off, and did a battery test. The battery passed, so it is not too bad. The test results show a runtime of 10 minutes.
 8. I changed the AH rating from 33 to 50, about half-way between the 33 and 75 numbers. I redid the system test, and now the runtime is 15 minutes. I left the AH set to 50 for now.

Once we actually have the batteries, we can determine the AH rating correctly for this unit.

9. Late afternoon, I shut both MMCR-DM and MMCR-radar off, and turned the UPS off. I turned the UPS on to watch it startup. DM now requires a password (Etlrad) during its startup sequence. The GPS program does not startup until someone logs into the MMCR-radar computer. The MMCR radar monitor is now running with UPS connected. Other than the passwords and startup issues, the MMCR came up running.
9. Wednesday, 6 August 2008, day 219. Oden continues its way north through the ice.
 1. LapXM had a queue full fault at about 23:49 last night. Matt restarted it about 1:44, so we lost a couple hours of data. In response to this, I modified the configuration file to be ASCOS_NoCalSPC_V3.cfg. It has no dwell display and saves the General Mode as a POP .SPC file. The dwell display has been dropped since it has trouble keeping up with all the heights and they aren't on the screen long enough to see if the radar is working correctly. With the POP files, we can use the Lapxm console in the updating mode to see some of the data, and we can read the files if we have questions about the operation.
 2. The S-band had three coherent integrator errors (0X02) overnight. This is not serious, other than it causes dwells to be dropped. This error will be watched. It is not a real error, but caused by a design error in the coherent integrator. (In fact, the 0X02 error was ignored in POP4, but for some reason is not ignored in LapXM). It is referred to in this document as a DSP error on the S-band. The only thing of significance about this error is that it means a dwell was missed in the sequence.
 3. LapMOM will not display the S-band data. This means we have no way to look at any day plots from the S-band.
 4. I added a user account on the MMCR-DM computer.
 1. User: Mailbox
 2. Password: etlrad
 3. Member of administrators
 5. Now the TimeSynch_das11.bat file I found on the Mailbox sets the time on the mailbox computer. I created a similar batch file on the MMCR-DM computer.
 6. I used the task scheduler on the MMCR-DM to synchronize the time with the MMCR-radar (set to GPS) at 30 minutes past the hour, each hour. I set the task scheduler on the Mailbox computer to do the time synchronization to MMCR-DM at 35 minutes past the hour, each hour. This seems like a lot of times, but means that when the systems start up, they never have bad times for more than an hour.
10. Thursday, 7 August 2008, day 220. We have been on the ship for a week. Matt and I took most of the day off. I did laundry and caught up some on sleep. The systems continue to run (MMCR, S-band, Mailbox). It was warmer with some rain. MMCR data show bright band part of the day at about 900 m.
11. Friday, 8 August 2008, day 221. It snowed some of the day and is colder.
 1. We restarted the MWR. The pitch and roll are not changing. Duane said to restart it to get them to work. They seem to be stuck on zero.
 2. I checked the times. Mailbox and DM seemed to be a couple of seconds off. I had not entered DM the DM password, so the timescale had not started. This is a small dis-

advantage of the way it is set up. If this were to be used in a long term situation, then the scheduler that Dave Carter used that runs as a service would be nice.

3. I note that on the MMCR the DC removal algorithm has not been implemented properly. DC is also not being subtracted, and is not being interpolated correctly. It draws a straight line across zero velocity. This gives larger widths and incorrect spectra. It also adds power to the spectra, making reflectivity off a little. This is shown in Figures 1 and 2. In Figure 1, the straight line across zero has been drawn in the spectra. It is fairly clear that this is not interpolated, but drawn straight across. The DC point is not zero, as it should be with DC removal on. In Figure 2, the straight edge of the contour is an artifact. In some cases, the contour should not cross the DC point.

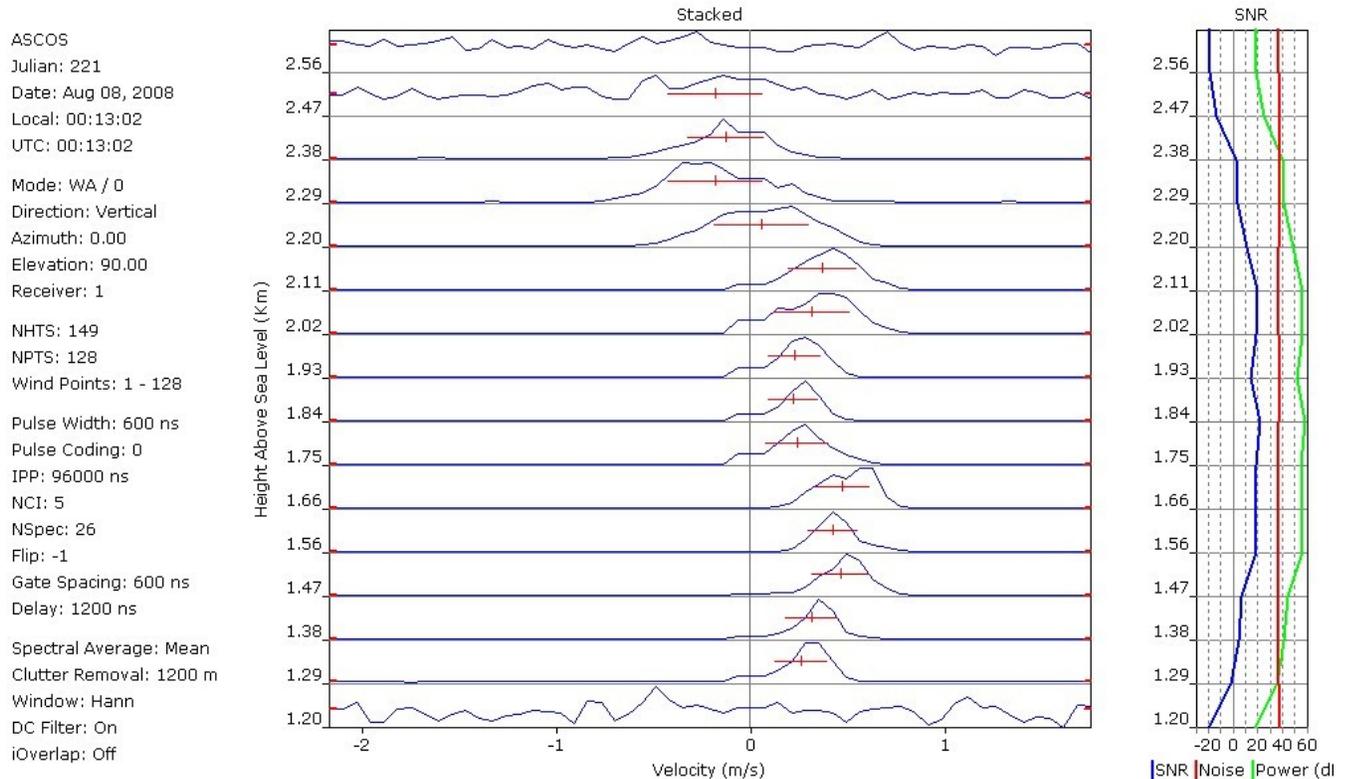


Figure 1. Stacked spectra plot from D08221a.spc. DC interpolation problem is evident.

4. I also note that the MMCR seems to be limiting somewhere. For example, in the day 221 data at 00:30:42, the strong signal shows third harmonic, a sign of clipping or limiting. It may be in the A/D, or earlier in the processing.
12. Saturday, 9 August 2008, day 222. We continue on our journey north. GPS puts us at 84.1N, 6.5W in the morning.
 1. MMCR shows three peaks in the snow. One peak at f , one at $-f$, and third at $-2f$. Sn Rs are in the +41 dB range.
 2. S-band shows image down 25-30 dB.
 3. Time synchronization is working on DM and Mailbox computers. Time is being set on MMCR-radar by GPS. Also, GPS is setting time on S-band and eventually the 449 computers.

13. Sunday, 10 August 2008, day 223. Continuing our journey north. Today we were near 85.3N, 10.8 W in the morning. Later in the morning it was windy and snowing. The snow was accumulating some on deck and turning to slush.

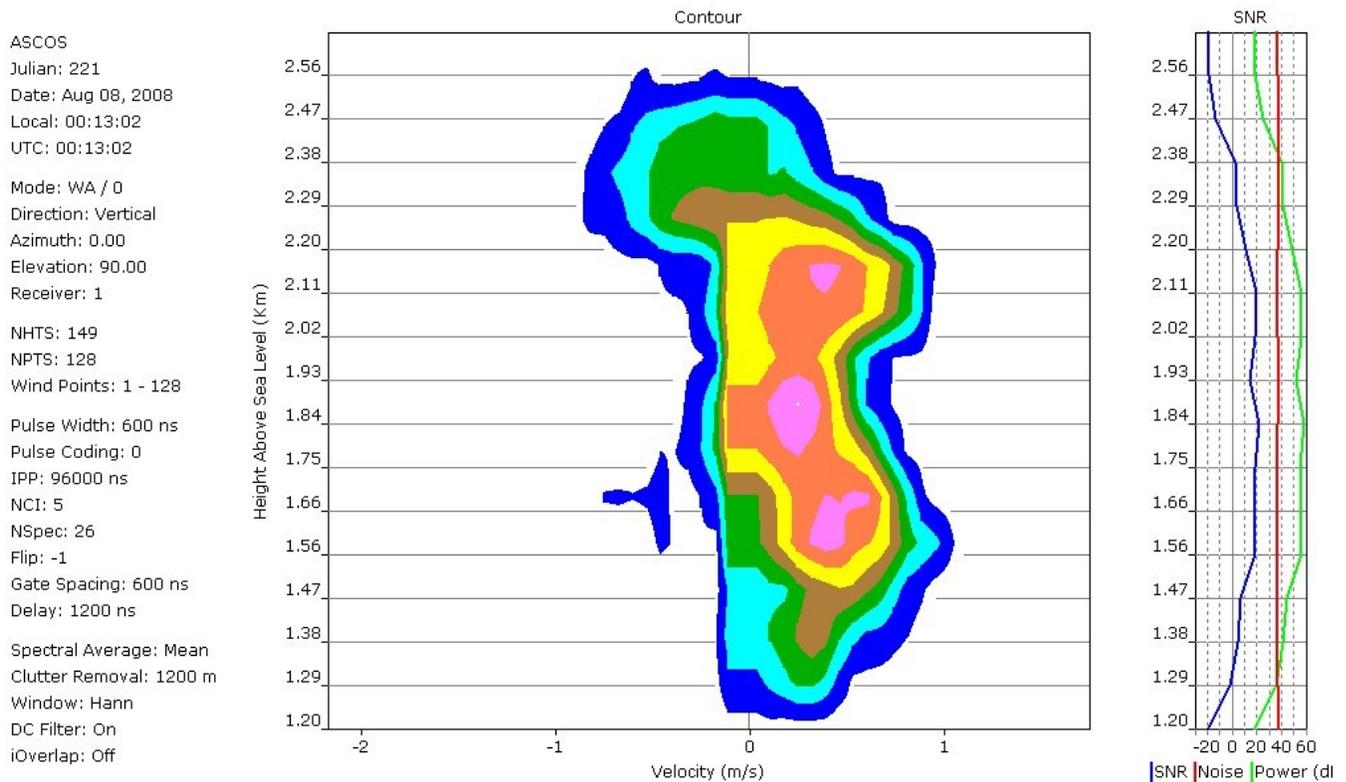


Figure 2. Contour plot of spectra from D08221a.spc. The DC interpolation problem causes the straight edge at the left side of the contours.

1. All instruments are running okay.
2. We are regulating the temperature in the container by opening and closing the door. There is a small change in the MMCR power level related to temperature, but it is hard to know if it is real or just the power sensor's sensitivity to temperature.
3. About 10:30 (UT) I turned off the MMCR. I temporarily installed the original DM disk as the second disk drive on the DM computer. I copied the files I thought I needed to [c:\FromOtherDisk20080810](#) on the DM computer. I renamed the radar monitor directory, and copied the directory from the original disk. After getting the DM computer back in shape, I restarted the system. I now have the current version of Radar Monitor running on the MMCR-DM computer.
4. I modified the MMCR configuration file to be ASCOS_CalSPC_V1.cfg, which has calibrations in it. I ran the daily calibration check, and it worked well. I changed the daily calibration check to 12:30 UT, just after lunch so we can watch it happen.
5. I tried to do the monthly calibration. Using DM computer, I looked at the caltable. I'm not sure it shows the 17:05 data. After dinner, I tried running the monthly calibration at 18:40. Looking at the event log, I find that it could not open the iControl file, so calibration was skipped. I also tried at 19:08, but could not verify that the calibration worked. I set up the configuration file to do a full calibration at 12:30 tomorrow, after lunch.

14. Monday, 11 August 2008, day 224. We continue to break ice and move north. We are north of 86° today.
 1. All systems continue to operate.
 2. In MMCR log, was "Did not find Corrected Power on Calibration Curve" error. (20080811 03:12:47).
 3. At 12:30, on MMCR, daily calibration check seemed to work, monthly did not appear to work. Tried again at 12:57 with same result. No changes seem to be made to the CalTable.nc, no logs, no errors.
15. Tuesday, 12 August 2008, day 225. We are above 87° today, looking for an ice floe.
 1. Matt went on the roof and got the MMCR pitch and roll cable. Once it was hooked up, we have pitch and roll working on the MMCR.
 2. We turned the mailbox computer off and on. Its pitch and roll sensor seems to be stuck at 0, 0.
 3. In the afternoon, we reached our ice floe. It is the third one we have investigated, and will be our home for a while.
 4. We started work on the 449 MHz Wind Profiler.
 5. We raised the 449 antenna, with the help of Joe Sedlar, one of the scientists from the University of Sweden.
 6. We lifted the Beam Steering Unit (BSU) up to the antenna.
 7. We fought the lids on the antenna element boxes. Next time the lids should be two or three pieces so that they can be handled by one or two people. They should be attached with bolts and tee-nuts. Several of the deck screws were broken, and others had stripped heads. We opened the boxes by breaking some of the screws. We also found some of the hardware inside the boxes had rusted.
 8. We installed the the antenna elements and tested them. The worst had a 16 dB return loss, the best 32 dB.
 9. We started cabling the antenna. Matt installed the airlines for the compressed air to the antennas. One or two of the antennas did not have pressure fittings installed, we we did not pressurize them.
 10. The numbering system I am using is 1N it the antenna closest to the bow, oriented perpendicular to the length of the ship. 12 N is the antenna with the same orientation, closest to the stern. 1E is the antenna closest to the starboard (right) side of the ship. 12E is the antenna closest to the port (left) side of the ship. 1N is the side of the antenna the Y+ beam points towards. 1E is the side of the antenna the X+ beam points towards.
 11. While we lifted the antenna the weather was not too bad. As the afternoon progressed it started to snow. By the end of the afternoon the wind was blowing and it was snowing and miserable under the antenna. I appreciated having Mustang suits that fit.
16. Wednesday, 13 August 2008, day 226. First full day on station.
 1. Matt and I finished connecting the cables to the antenna. I checked the return losses to the entire antenna:

Code	Return Loss (dB)	Second Return Loss (dB)
0	12.96	12.89
1	15.34	12.88, 20.26@451.4 MHz
2	12.70	18.13
3	27.54	20.91
4	18.20	20.00
5	26.30	19.83

2. About 14:30 the UPS on the MMCR triggered a shutdown. No such problem on the S-band UPS, and the large 60 Hz UPS didn't seem to stop. I was in the container and observed no error.
3. Log from the MMCR UPS showed Line fault errors at 14:20 and 14:35, with R-system (Inverter?) turned on at 14:25 for 3 s. The alarm log showed D-Low runtime left at 14:20:21. This alarm is the one that triggered the shutdown.
4. I turned the UPS control off in the MMCR Radar Monitor.
5. When the MMCR started it started with the wrong configuration file. This has been fixed. The problem was that it was set to automatically start with the wrong file. There were about 10-20 minutes of data collected with the wrong file. It shouldn't affect the data, as the differences had to do with calibrations and no calibrations were scheduled during this time.
6. About 15:00 the ship started shifting 90° from the mooring it was located.
7. About 19:30, Cassie brushed the ice off the MMCR antenna. There were about .5" diameter, .25" thick drops of ice on it.
8. Matt hooked up the ceilometer.
9. About 20:10, the 449 nearly hooked up. Matt has retightened some connection on the antenna. I repeated the return loss measurements of the antenna. These appear in the second measurement column of the table above.
10. We tripped the breaker that had the S-band, 449, Mailbox, and Ceilometer on it.
11. We moved the 449 TX power supply to 50 Hz.
12. We moved the ceilometer to 50 Hz. I think the heaters on the ceilometer were the main problem.
13. We moved the 449 video monitor to 50 Hz.
14. The 449 compressor is already on 50 Hz.
15. I am setting up the 449 with the Y+ beam (N) to bow of ship, X+ (E) to the starboard. The Y axis is on the NC positions of the polarization switches.
17. Thursday, 14 August 2008, day 227. All systems except the 449 are running.

1. I looked into the BSU under the antenna and determined the directions of the beams. As I found out later, I was wrong. Later in the day I corrected the table, so we took about 6-8 hours of data with the wrong directions in the data.
2. I did several tests in the morning testing different parameters sets and antennas. These tests are saved in the \TestData directory. I decided on Code 0 for the vertical beam, and Codes 4 and 5 for the obliques. For the low mode, I set up 60 m pulse lengths with 30 m sample spacing. For the high mode, I set up 200 m pulse lengths, 8-bit coding, and 100 m sample spacing. The lowest gates were set at about 150 m and 674 m.
3. On the 449 Radar Monitor, the TX V and I aren't reading. The power supply shows V=32.6 V, I=2.1 A in the low mode, 9.6A in the high mode. The Monitor shows that the forward power is about 900 W. One of the divider temperatures is warmer by 5-6° C.
4. I talked with Jim Jordan and Tom Ayers by Iridium phone. On this system, the transmitter voltage and current are not hooked up. They said with about 5% duty cycle, the current should be about 10 A. I am seeing 9.6 A with over 8% duty cycle, so my transmitted power may be lower than it should be. Tom said he thought that the temperatures were about 5° when there was a problem (in a later call, he said he had checked and it was 12° when bad).
5. Jim suggests trying to turn off external Riddle and use internal Riddle in the MPP algorithm. It is not clear how to do this, so I left it the way it is. The data can be reprocessed to bet better moments.
6. With antenna code 5, the J1 temperature climbs to about 6° above the others. In antenna code 4, J2 is about 4° C warmer.
7. About 16:30, I stopped the radar to look at the antenna. Matt checked connections to 1 & 7 N antennas, and 2 & 8 E. I checked the BSU and determined that my first analysis was WRONG. The correct beam pointing table is shown below:

Code	Azimuth (°)	Elevation (°)	LAP-XM direction	Ship direction
0	0	90.0	Vertical	vertical
1	90	90.0	Vertical	vertical
2	0	74.7	North	Towards Bow
3	90	74.7	East	Towards Starboard
4	180	74.7	South	Towards Stern
5	270	74.7	West	Towards Port

8. At 17:14:11 the 449 wind-profiler was restarted with the correct beam directions. It is running sequence WAB_045, using the configuration file ASCOS_449_V1.cfg.
18. Friday, 15 August 2008, day 228. First full day with everything running.
 1. The MMCR shows no errors and keeps running. The writing of only the general mode to the POP .SPC file is enough to let us see the data without filling the process queue.

2. The S-band radar continues to show one or two DSP errors each day, but continues to run reliably.
3. The ceilometer, now on the S-band computer, is working well.
4. The MWR is running. The pitch and roll seem to be locked on 0, 0.
5. The 449 is running. TX current is 9.8A in the high mode, 2.1 A in the low mode. TX voltage is 32.6 V. J1 don the divider is still warm on WB/5 (High mode west beam). J2 is warmer during WB/4 and WB/0 (South and vertical high modes). There are issues with clutter and the way that the Multiple Peak Picking (MPP) algorithm is choosing the moments.
6. I distributed preliminary data from the 449 via email. Figure 3 shows the low mode data for today. Some of the problems are from clutter. Others are from the MPP algorithm not selecting the proper peak. The high winds in hour 21, for instance come from the MPP locking onto some interference signal.

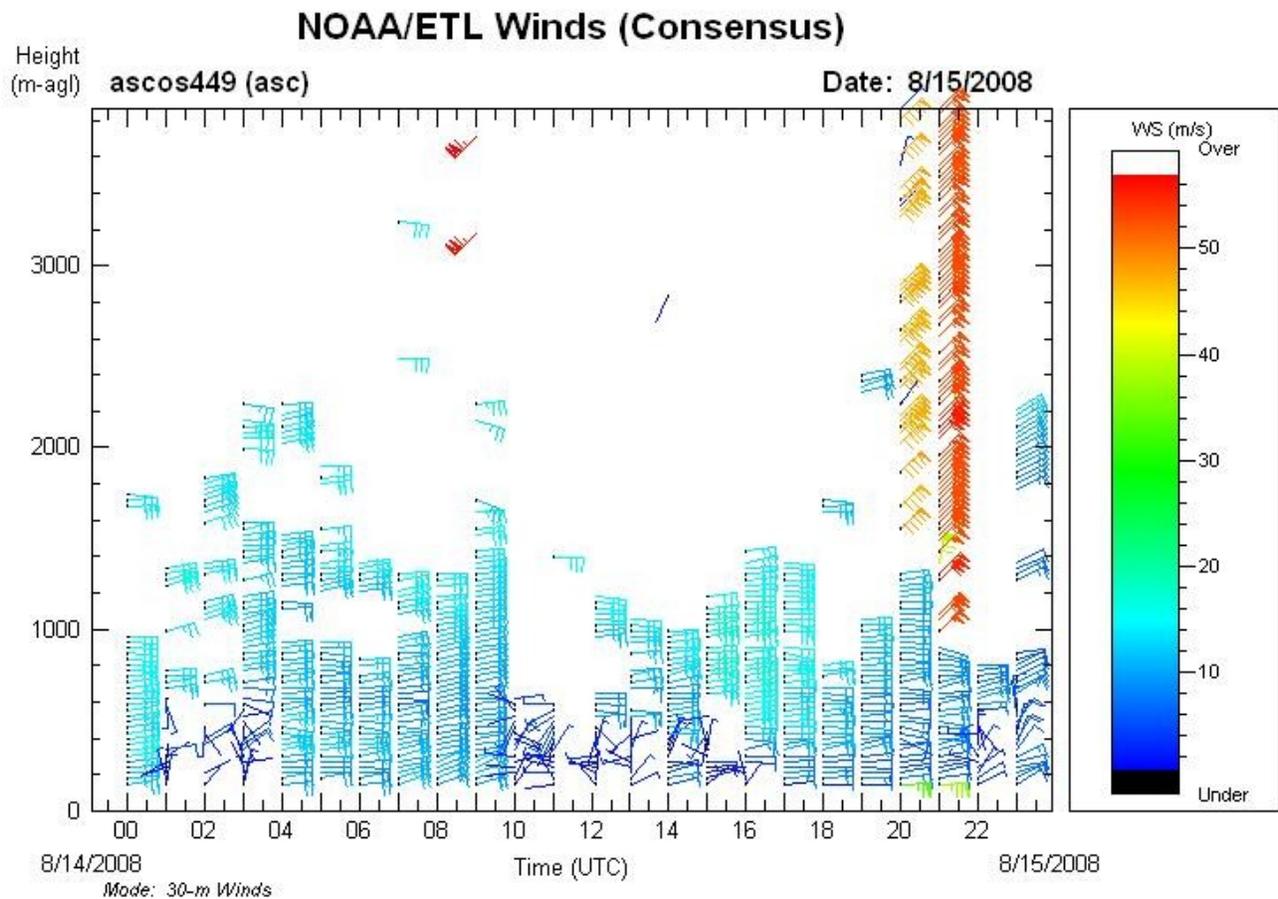


Figure 3. Preliminary first results from the 449 Wind Profiler on the Oden. Data is from a 60 m pulse that has been sampled every 30 m.

7. I modified the configuration file to be ASCOS_449_V2.cfg. Changes include the addition of normal spectra (no wavelets) with normal moments and interference reduction algorithms. This data is going to \TestData. There are also consensus files from this data,

going to the same directory. This configuration started running about 11:00.

8. About 12:00 I went to ASCOS_449_V3.cfg. This changed the number of points in the spectra from 256 to 128, and the number of spectral averages to 32 from 16. This was an attempt to deal with the clutter at about 3 Hz.
 9. I looked through S-band data. We will probably not have precipitation aloft above 8 km that will be visible to the 449. About 13:00 I changed to ASCOS_449_V4.cfg, with shorter Inter-Pulse Periods (IPPs) and more coherent integrations on WA mode. Tx current went from 2.1 A to 2.5 A.
 10. 13:31:41 may have the helicopter in the data.
 11. There is persistent interference in the spectra. It is weak and will be hard to track down.
 12. Looking at the A-scan time series, I can see that none of the inputs are saturating the A/D input. It doesn't mean they aren't limiting.
19. Saturday, 16 August 2008, day 229. At first check in the morning (8:10), all systems were running okay. No errors were apparent on any of the three radars.
1. About 9 AM, I shut down the 449. I checked the splitter connected to J1 (antennas 1 & 7) on the east antenna. It showed a 23 dB return loss. I checked the J2 splitter on the north antenna (antennas 2 & 8), getting a -24 dB return loss. This means the antennas are okay.
 2. Matt and I checked the level of the antenna. Using the port, stern corner as reference, the port-forward corner was 6 cm high. The forward-starboard corner was 2.5 cm low. The aft-starboard corner was 8.5 cm low. The 8.5 cm corresponds to a $.66^\circ$ tilt. 2.5 cm is a tilt of $.2^\circ$. We left the antenna in that position.
 3. About 10 AM, restarted the 449 with ASCOS_449_V6.cfg. This configuration has more heights in the 60 m.
 4. On the 449, MPP screws up in the clouds a lot of the time.
 5. In WB/5 mode, J1 gets about 4.7° C warmer than others, in WB/0, J2 is about 2° warmer.
 6. I wrote emails about some of the problems and showing results.
20. Sunday, 17 August 2008, day 230. Matt and I slept in this morning.
1. Yesterday's 12:30 daily calibration failed on the MMCR. Today's ran okay.
 2. The atmosphere is clearer today. The 449 low mode is not observing too high.
 3. About 1300, I changed the 449 to ASCOS_449_V7.cfg. This one has a 4-bit code in the 60 m mode. The transmitter current went from 2.5 A to 4.8 A. This gives errors about timing out waiting for the DSP. When I dropped back to 120 heights, it works. I ended up with 130 heights, covering 150 m to almost 4200 m.
 4. We are still seeing a signal that looks like something rotating. Matt turned off the 60 GHz radiometer for a short while, but the signal did not go away. This means the rotating head on the radiometer is not the cause of the signal.
 5. About 1500, I turned the 449 off for a short while to inspect the antenna. The west beam has a bad sidelobe issue. I checked the antennas to make sure they are all in the same direction. As best I can see, they are. There is a minor question whether the antennas from

different batches use the same direction notation. Figure 4 shows an example of the sidelobes. The multiple peaks are from different sidelobes. I have tried the east beam, and it also has the sidelobes. The sidelobe appears to be in the East/west plane, parallel to the big wall of the superstructure of the Oden. It appears to only be down 10 dB over the two-way radar path. When the echo comes from clear-air, only the first sidelobe appears. If the velocities are carefully examined, the sidelobe is found to not be symmetrical about the vertical. Over the course of installation and initial testing of the radar, we checked and double checked the connections and setup of the antenna. We eventually gave up and left the antenna in this state.

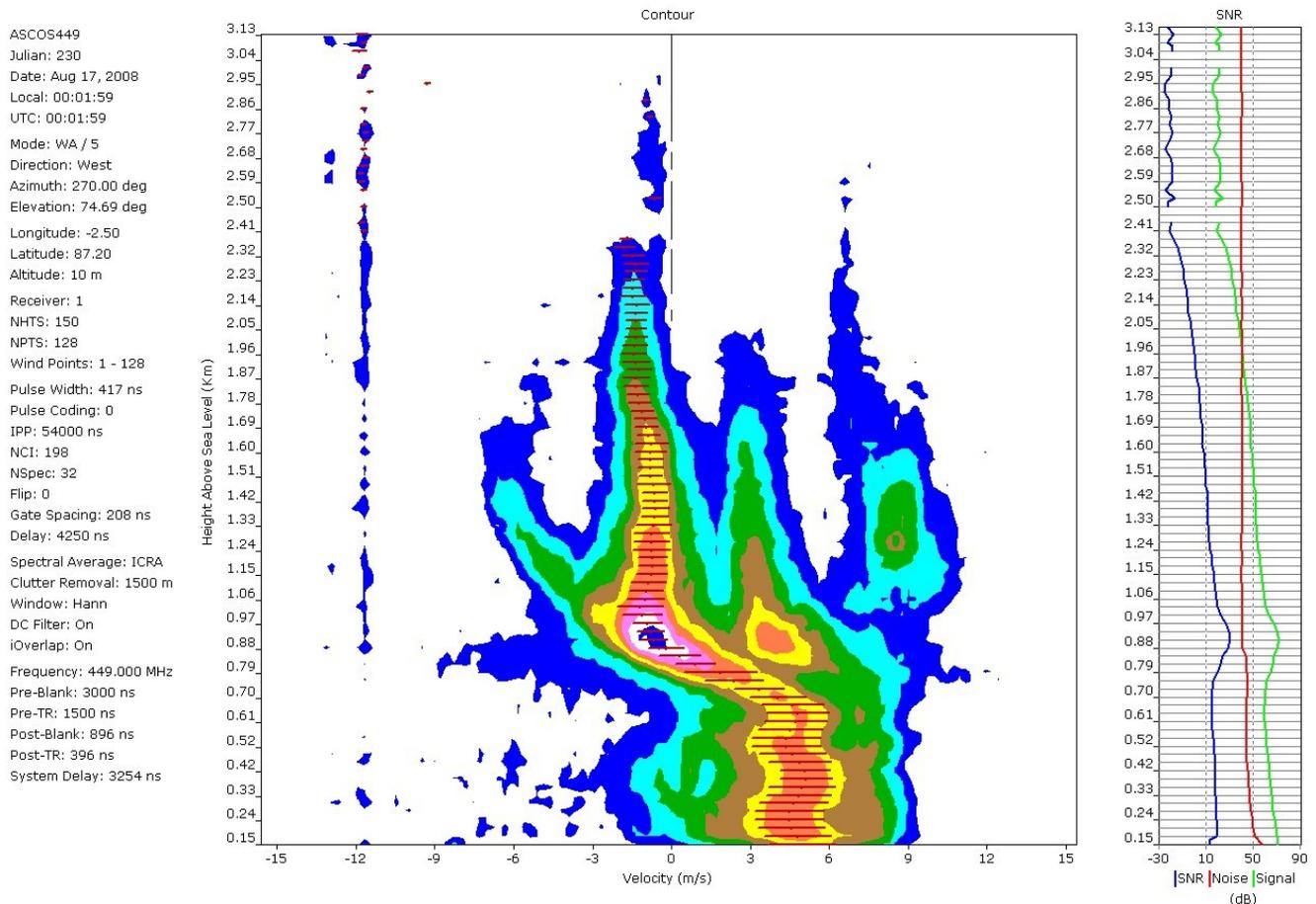


Figure 4. Contour plot from 449 wind-profiler showing returns from multiple antenna sidelobes. The lowest contour is 2 dB above the noise. The contour increment is 5 dB.

6. About 1600, I turned the 449 off for about 30 minutes while I checked the BSI and some of the antenna connections. As near as I can determine, everything is okay.
 7. Changed to ASCOS_449_V8.cfg, using East (3) beam instead of the west beam.
 8. We are still having sidelobe problems. They are now on the other side of the spectra.
 9. Other systems are running well and looking great.
21. Monday, 18 August 2008, day 231. All systems running. No errors on any radars at start of day.
1. The MMCR pitch is at 2°. The ship has been listed to port for more than a day. They are fixing a tank and will level it out later today. Note that it is the pitch that seems to be sensing

what is normally roll on a ship. MMCR pitch seems to be showing starboard/port angle (port +), and the roll sensor shows forward/aft angle.

2. The 449 continues to run. Transmitter current is 4.8 A in low mode, 9.7 A in high mode (32.7 V).
3. I held the high modes about 8:18 to let the thermistors on the BSU stabilize. Both show J1 as a problem today:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	7.38	4.34	6.24	3.34
J2	4.15	1.11	3.70	0.8
J3	4.49	1.45	3.92	1.02
J4	3.04	0	2.90	0
J5	3.43	0.39	3.02	0.12
J6	4.85	1.81	2.96	0.06

4. I stopped the 449 just after 900. Cassie and I checked the East/West antenna physical connections. All antennas go where they should. I took the cable off the the J1 port and the reference polarization switch. Using an ohmmeter, I verified that the switch is working correctly. I then put all of the cables back (BSU is hard to work on in this position).
5. Just after 1000, I restarted the 449. There are still sidelobe issues. At 10:10, I held the 449 on South and East high modes to measure the temperatures again.

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	5.07	4.7	4.52	4.23
J2	1.82	1.45	1.29	1
J3	1.91	1.54	1.43	1.14
J4	0.37	0	0.29	0
J5	0.60	0.23	0.51	0.22
J6	2.07	1.7	0.36	0.07

6. Between 1000 and 1200 the ship turned around, so heading changed 180°.
7. The daily calibration check ran with no errors on the MMCR at 12:30.
8. Between 12:30 and 13:00, Matt and I re-routed the MWR cables. He is observing spikes in the data and we are trying to minimize cross-talk.
9. At 13:12, the MMCR Radar Monitor shows pitch and roll at 0.3° and 0.2°, so the ship is close to level.
10. At 18:00 we stopped the 449 radar (and turned off transmitter) to measure the 449 antenna pointing direction. The MMCR pitch and roll are 0.31° and 0.19°. The 449 is within

0.1° of this, so we consider the 449 parallel to the MMCR.

22. Tuesday, 19 August 2008, day 232. All systems running. The S-band had two DSP errors overnight. MWR pitch and roll seem stuck at -0.027.

1. About 10:09, I changed the 449 to run ASCOS_449_V9.cfg. This uses an 8 bit code in the 60 m dwells. Now the transmitter current during the low mode is 7.8 A. It is hard to tell if the lowest levels are good, as the winds are very low today. The 0.73 m/s echo seems to be smaller today. It may be the coding, or just the way it is today.
2. The MMCR reported errors going back before 20:00 last night (probably to 13:00 yesterday) "Could not read calibration table NetCDF file", and associated errors. About 10:30 Matt and I replaced the CalTable.nc that is not readable with IDL with a yesterday's table, which is good. The 12:30 calibration check worked and wrote a good cal table today.
3. About 11:20, Matt and I restarted the MWR. He is finding the data is messed up. Looking further, it is the pitch and roll that have been off. The data can be recovered by reprocessing.
4. About 1300 I started noticing bad interference on the 449. It is strong and probably affecting the data. I put out an email to ASCOS participants to see if something had been turned on, but found nothing. Interference continued throughout the day. Transmitter current on 449 high mode is 9.8 A. Splitter temperatures were about the same, measured about 1600:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	6.92	4.35	5.63	3.24
J2	3.52	0.95	3.26	0.87
J3	4.10	1.53	3.39	1
J4	2.57	0	2.39	0
J5	3.03	0.46	2.46	0.07
J6	4.53	1.96	2.40	0.01

5. We had a fire drill at 1530. With the portable phones, we get the alarm in the container, via the phones.

23. Wednesday, 20 August 2008, day 233. We had a polar bear close to the ship about 6 AM today. It was about 100-200 m from the ship, and stayed around about ½ hour before being chased away. It snowed lightly part of the day.

1. All three radars show no errors. MMCR shows cloud reaches to 6.3 km.
2. Ceilometer and MWR working normally.
3. 449 still has interference issues. About 9:30, I stopped the S-band, unloaded LapXM, and disconnected the power to the I/F and RX units. This dropped the interference on the 449 a lot. There is still a little there, but this killed the strong stuff. I changed the routing of the 449 antenna control cables so they are not parallel to the S-band cables. This seems to have dropped the level of the interference to a tolerable level. I'm not sure if the interference signal was actually coming from the S-band (I suspect it was.), or if it was coming in on the cables. Throughout the day I watched the 449. The interference is not gone, but it has been

reduced to a tolerable level.

4. About 12:10, I turned the MMCR off and cleaned the ice and snow off the antenna. It was off for about 5 minutes.
5. Error log on MMCR showed many "Did not find Corrected Power on Calibration Curve" errors at 10:35:27. These did not persist, and were there for only one record.
6. At 15:00 we had a mandatory meeting about polar bears and safety. Higher visibility and more guards will be required on the ice. This morning's bear encounter was too close.
7. At 16:02:05, I started running ASCOS_449_V10.cfg on the 449. This has 256 point spectra instead of 128. I think this will give better definition to the clutter signals making it easier to separate them out. I measured the thermistor temperatures:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	4.86	3.39	4.10	2.81
J2	2.03	0.56	2.00	0.71
J3	3.08	1.61	2.37	1.08
J4	1.47	0	1.29	0
J5	2.35	0.88	1.36	0.07
J6	4.06	2.59	1.34	0.05

24. Thursday, 21 August 2008, day 234. Decidedly cooler today. Lowest thermocouple on 449 power splitter reads -5. Inside it is 15.5° C, MMCR reads about 20. I will shut the door a little more so it warms some.
 1. All systems show no errors at the start of the day.
 2. MWR pitch and roll are 0.0, MMCT pitch is 0.31, roll is 0.19.
 3. I looked at the noise (using my routine pdanoiseavNREL) on part of day 233 on the 449. It looks like the interference was causing a 2 dB increase in the the noise level. This would reduce sensitivity. Figure 5 shows the noise level, recalculated from the spectra by a program I have written for noise studies. The enhancement during 233 is very easy to spot. The drop at the end of the plot was caused by changing the number of spectral points from 128 to 256, and should be expected. The bad period of interference during days 232 and 233 showed enhanced noise of more than 2 dB. This corresponds to a degraded Signal-to-Noise Ratio (SNR) of 2 dB. I don't know the source of this interference, but changing the cable routing suggests that it was internal to our equipment. This should be examined and some work done to reduce the interference, if at all possible.
 4. MMCR daily calibration failed. Errors suggested that RF level was just outside the allowed limits. MMCR continued using the previous caltable.
 5. About 20:30 through 21:30 (or later) the ship moved and turned.
25. Friday, 22 August 2008, day 235. The sun was out in the morning. A few high cirrus were visible. It is colder, -6° C. There is a thin layer of ice on the sea where we moved last night. We had glog on the helideck for afternoon coffee break. It was a nice get together, and a little break in the routine.

1. The S-band had one DSP error overnight. MMCR and 449 showed no errors overnight. The MWR is running okay.

449 average noise level (dB)

20080906 PEJ

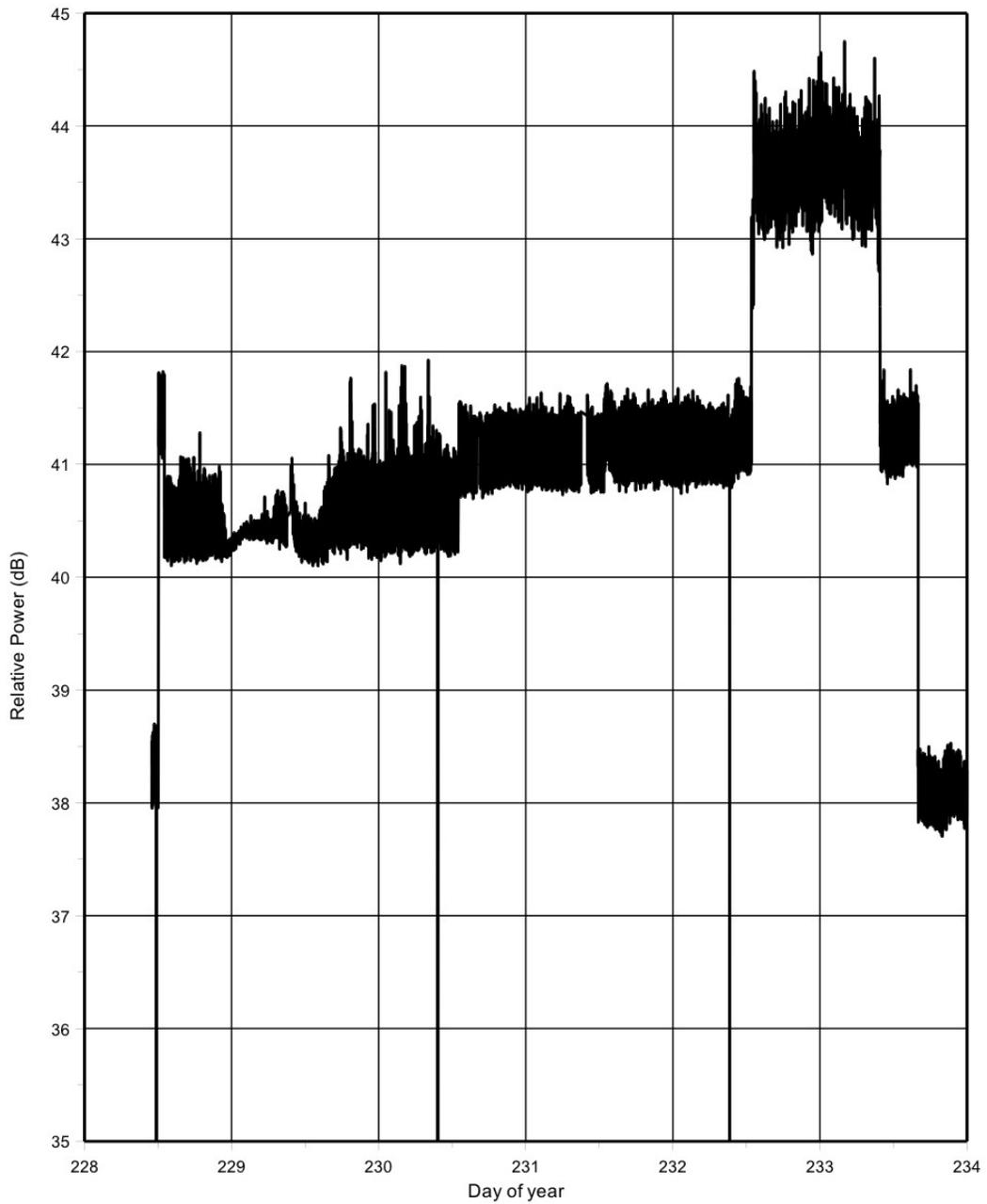


Figure 5. Average noise levels for the low mode of the 449 radar.

2. Looking at the 449 winds, they will need a lot of post-processing. Sometime last night,

MPP started locking onto a weak interference line in the vertical. Bad Winds!

3. About 8:45, ship is level, winds are light. Watching the wavelet and normal processing, when the winds are zero, or near zero, the wavelet process seems to remove a lot of signal.
 4. About 10:40, there is a fog rolling in, blue sky overhead.
 5. 449 transmitter voltage is 32.7 V, current is 9.7 A and 7.8 A. The S-band transmitter currents are 259 and 1205 mA.
 6. About 13:15 I discovered that daily calibration check on the MMCR had killed the caltable.nc file again. I copied yesterday's caltable to the correct location and restarted the MMCR.
26. Saturday, 23 August 2008, day 236. Visibility was down today. There is rime or frost on the 449 antennas.
1. At about 8:20, the S-band showed one DSP error overnight. No errors on 449 or MMCR. Ceilometer running okay. MWR appears to be running okay.
 2. I looked some at the MWR data. It appears that the spikes that Matt is observing happen even when the 449 is OFF. This rules out one possible source.
 3. I screwed up! For some unknown reason, the S-band computer rebooted about 10:42. The radar came back up, but the ceilometer needs manual restart. We lost about 1.5 hours of data on the ceilometer until I noticed it was off.
 4. On the S-band, transmitter currents are 268 and 1244 mA. On the 449, they are 9.7 A and 7.8 A. About 10:10 I measured the junction temperatures on the BSU power splitter:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	1.78	1.18	4.15	3.37
J2	2.11	1.51	1.62	0.84
J3	0.86	0.26	2.11	1.33
J4	0.60	0	0.78	0
J5	1.73	1.13	0.83	0.05
J6	0.79	0.19	0.89	0.11

27. Sunday, 24 August 2008, day 237. Matt and I slept in this AM.
1. About 11:15, S-band shows one DSP error overnight. Ceilometer running normally, shows clouds at 200 and 660 m. MMCR shows bad cal table, probably since yesterday. Had some minor problems getting it stopped and restarted.
 2. Replacing a bad caltable on the MMCR with another bad caltable is not good. About 11:40, I finally got a good caltable installed (caltable from day 234).
 3. About 12:30, at Coy's suggestion (via email), I put the MMCR event log on level 6. This shows the calibration check progressing normally. The IDL program on the MMCR-DM computer can't read the caltable created today.
 1. IDL can read [\\MMCR\c:\LapxmData\MMCR_data\20082371230CalTable.nc](file://MMCR/c:/LapxmData/MMCR_data/20082371230CalTable.nc).

2. IDL can not read [\\MMCR\c:\Program Files\Crada\Lapxm\MMCR_control\Caltable.nc](#), which was created at the same time as the file mentioned above.
 3. There are two processes that write the caltable at the same time. I don't fully know how the data is moved around on the two computers. The data in c:\Lapxmdata\MMCR_Data gets moved to the DM computer by some process I don't know. This system should be modernized and run on one computer. Having two computers running interconnected processes is not the best way to do things.
 4. About 13:09 I stopped the MMCR to clear the antenna. There was about .25" of ice and snow on the radome. I used a 2x4 to scrape it off. Approximately 13:20, I restarted the MMCR.
28. Monday, 25 August 2008, day 238. There was a skiff of snow last night. Winds are very light.
1. About 8:30, S-band, 449, and MMCR show no errors. Ceilometer running with no errors. MWR running with no errors.
 2. Matt complains, correctly, about the hourly consensus files. Some hours only the high mode appears in the files.
 3. Starting about 10:45 until about 12:00, the ship moved to heading 267°.
 4. The S-band had a DSP error about 14:15.
 5. S-band transmitter current (about 17:00) is 1192 and 258 mA. The 449 current is 9.6 A and 7.8 A. I held the system to get stable junction temperatures:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	-1.97	1.54	-0.03	3.68
J2	-2.37	1.14	-2.74	0.97
J3	-2.88	0.63	-2.83	0.88
J4	-3.45	0.06	-3.71	0
J5	-2.43	1.08	-3.56	0.15
J6	-3.51	0	-3.65	0.06

29. Tuesday, 26 August 2008, day 239.
1. About 8:30, S-band had one DSP error overnight. Ceilometer running okay. MMCR running normally, no errors. MWR running okay. 449 shows no errors. Height coverage on 449 has increased since midnight, from about 2000 m to 3000 m now, 60 m mode.
 2. 9-10, ship turning 180°, new heading 82°.
 3. 9:44:18, loaded ASCOS_CalSPC_V2.cfg on MMCR. This configuration file writes the caltable.nc file to two directories, not in the same place. It will also do the monthly calibration on 1 September, at 12:30.
 4. Matt still sees spikes on the MWR. About 11:28, he moved MWR cable back to top of container. These cables had been between the two containers.
 5. 12:30, errors on the MMCR with one caltable. My bad! I didn't copy a caltable.nc file into

the new directory, so it could not open it to make the calibration check. I copied most of MMCR_control into the new directory (MMCR_control2). The caltable that was written is good. It is readable by the IDL program.

6. I checked the ceilometer settings. The height offset is set to 0.0. Matt is checking the ceilometers on the ship, and may have a height offset between the data sets.
7. 13:10-13:12, Matt is still seeing spikes on the MWR. We pulled the cable from the roof of the container and put it in the vestibule.
8. 17:13 held the 449 on East and South high modes to get divider temperatures. I hold the modes until the temperatures have stabilized and don't change for at least 10 seconds. The transmitter currents on 449 are 9.5 A and 7.7A. The S-band currents are 1224 and 265 mA.

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	0.80	1.22	2.98	3.48
J2	0.75	1.17	0.42	0.92
J3	0.24	0.66	0.68	1.18
J4	-0.30	0.12	-0.50	0
J5	0.54	0.96	-0.41	0.09
J6	-0.42	0	-0.50	0

30. Wednesday, 27 August 2008, day 240.

1. About 8:40, S-band had one DSP error overnight. Ceilometer running okay. MMCR shows no errors. MWR running, though there may still be spikes in the data. 449 running okay.
2. The moments being chosen on the 449 are not too good. The 700-800 consensus file does show the low-level jet at about 400 m that was observed with the 0600 radiosonde.
3. 12:33 I observed a new error on the MMCR. It started about 9:32, and can't write data to one of the targets. The problem is that the LACIE drive is full. I picked one that has 93 GB of old data on it. I installed the second LACIE and now the MMCR does not have an error. There are 2-4 hours of data missing from the LACIE backup, but Matt has them in his archive.
4. Why is it so hard to remove the removable disk? There is no good reason why the disk should be installed in a hard-to-get-to place. Also, this would be a perfect place for wing nuts or something that does not require a wrench to remove.
5. The MMCR needs a major upgrade. It is frustrating to use the LapXM Console to look at the data and not see the error log.
6. The S-band currents are 1224 and 265 mA. The 449 transmitter currents are 7.7 A and 9.5 A. The thermistor temperatures are (measured about 17:03):

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	-0.45	1.19	2.23	3.89
J2	0.32	1.96	0.32	1.98

J3	-0.80	0.84	-0.47	1.19
J4	-1.42	0.22	-1.66	0
J5	-0.67	0.97	-1.53	0.13
J6	-1.64	0	-1.65	0.01

31. Thursday, 28 August 2008, day 241. Lightly snowing in the morning. Cloud to 1.1 km.
1. At about 8 AM, all instruments running okay. No errors on the radars.
 2. MPP not picking peaks very well, but this has been a problem the entire mission.
 3. About 8:30, the ship is turning to get better air samples.
 4. About 8:30, we turned the 449 off. Cassie and I tied the antenna elements down in preparation for transit to Longyearbyen. The antenna seems pretty stable. Some screws need to be tightened, but with the sticks on it, it doesn't bounce like it does empty.
 5. About 9:40, MMCR had an error. No logs that I find show why. The screen message said something like "F5 Dakar PCI board not found". MMCR restarted and is running okay.
 6. About 9:40, Matt and I put some foam over the MMCR to try to keep it warmer. Looking at earlier data, it appears that this is not a new problem.
 7. It is cooler out. All BSU temperatures are in the -4.7 to -4.9 range.
 8. About 10 AM, ship is done moving. Have finished working on 449 antenna and restarted it.
 9. Just after 12:30, MMCR daily calibration check worked as it should. CalTable.nc was written in two places. The one in ...\\MMCR_Control, which is the one used by LapXM, is readable by the IDL program.
 10. About 14:30, the tethersonde is probably in the East beam of the 449.
 11. I removed to LACIE drive from the MMCR case, and installed the one we are using. This is a place where wing nuts should be used. I put the full one in the LACIE box, then in the storage box with the others.
 12. About 15:30, back from coffee break. Tethersonde is down right now. There is some interference on the 449, but it is very minor. Clutter is not quite as bad on the East, but there is still some there.
32. Friday, 29 August 2008, day 242. I talked with Joe and Michael at breakfast. Joe ran the tethersonde from 2 to 6 this morning. He said the winds were very light and the sonde did a complete spiral between the surface and 400 m. Michael said the radiosonde also showed light winds with a spiral.
1. About 8:10, all systems running. No errors overnight.
 2. The 449 shows a spiral in the winds, but with a little longer turning.
 3. Between 9:30 and 10:15 the 449 was off. Matt tightened down the antenna. Cassie and I tied down the BSU. We strapped down the antenna stick boxes.
 4. Matt put more permanent foam and plastic over the mailbox. The foam seems to have helped some. Now it will be waterproof so the foam doesn't get wet.
 5. During much of the morning the tethersonde has been over the 449. At 1100, the

tethersonde is almost directly in the East beam, with the tether going over the antenna. We are not getting anything useful below about 850 m. The tethersonde may have passed through the MMCR beam also.

6. Just after 12:30 the daily calibration check ran on the MMCR. No problems occurred and I can read the CalTable.nc file with the IDL program.
7. 13:55 to 14:03, I turned off the 449 and went onto the antenna with Ola, the Chief Officer, to check to see if it is ready to travel. Ola says it is okay to go. He is a little concerned about the S-band antenna, esp. when we get to open sea.
8. About 16:56, MMCR reported an error, unable to open D08242a.spc. This occurred while Matt and I were reading the file with LapXM Console. It would be nice if the MMCR had the current version of the software, since the file locking is a little better in the newer version.
9. About 1700, S-band transmitter currents are 1215 and 262 mA. The 449 currents are 9.5 A and 7.6 A. I paused the 449 in the East and South high modes to check the BSI temperatures:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	1.79	0.68	5.52	4.6
J2	2.11	1	2.17	1.25
J3	1.71	0.6	2.60	1.68
J4	1.17	0.06	0.92	0
J5	1.96	0.85	1.46	0.54
J6	1.11	0	1.17	0.25

33. Saturday, 30 August 2008, day 243. I went cross-country skiing last night. Matt and I slept in late this AM.
 1. About 12:30, the S-band showed one DSP error overnight. The 449 and MMCR showed no errors. The ceilometer and MWR are running okay.
 2. The daily calibration check on the MMCR ran with no problems.
 3. Matt looked at the recent MWR data. There are still periods with spikey noise, but there are also good periods.
 4. 13:00 through 14:00, the ship turned 180°.
 5. About 16:50 I turned the 449 off to measure the levelness of the antenna, with Cassie's help. Using the laser level, we measured the levelness of the 449 antenna. Using the aft, port corner of the antenna as the reference, we measured the forward, port corner to be 2.5 cm lower, the forward, starboard corner 2.5 cm high, and the aft, starboard corner 6 cm high. 6 cm corresponds to a tilt of 0.47°. The MMCR pitch (which is the port-starboard direction the way it is installed) is 0.0°. The MMCR roll (forward to aft direction) is 0.35°. This means the 449 antenna is within 0.5° of level. I consider this close enough, given the movements of the ship, and the difficulty working on the antenna.
 6. About 17:15, the S-band transmitter currents were 257 and 1215 mA. The 449 transmitter currents were 9.6 A and 7.7 A. I held the 449 in the high modes to measure the BSU splitter temperatures:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	-2.31	0.46	0.54	3.35
J2	-1.80	0.97	-1.94	0.87
J3	-2.21	0.56	-1.03	1.78
J4	-2.57	0.2	-2.81	0
J5	-1.69	1.08	-2.45	0.36
J6	-2.77	0	-2.51	0.3

34. Sunday, 31 August 2008, day 244. I went to coffee at the usual 10:00. I got a call to be "tourist" on the morning helicopter flight, leaving in 15 minutes. I got to ride on a sampling and profiling flight. We flew away from the helicopter to an open spot in the clouds then went up to clean atmosphere. We went to 12000', then stopped and took an air sample. We took and additional seven samples on the way down. It was quite a view and trip.

1. About 8:15, No errors on any instruments. MWR pitch and roll may be working.
2. 449 is locking onto tether sonde or clutter down low.
3. After lunch, the sun is out full. Barely any echo on MMCR. 449 height coverage down a little.
4. Just after 12:30, the MMCR daily calibration worked.
5. About 13:10, there is a ground fog developing. Ceilometer was showing nothing, now a 60 m base. MMCR now has data in lowest few gates.
6. On the 449, there is often a noise jump, possibly related to a spike in the time series on the high mode around 6 km. One example is Day 244, 15:43:16.
7. About 19:10, S-band transmitter currents are 250 and 1174 mA. The 449 transmitter currents are 9.6 A and 7.7 A. The 449 Radar Monitor reports 966 W forward power, 62 W reverse, 1.68 VSWR. I paused the 449 in the high mode to get stable splitter temperatures:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	-3.86	0.62	-1.48	2.96
J2	-3.40	1.08	-3.72	0.72
J3	-3.38	1.1	-3.02	1.42
J4	-4.20	0.28	-4.44	0
J5	-3.32	1.16	-4.13	0.31
J6	-4.48	0	-4.13	0.31

35. Monday, 1 September 2008, day 245. The first day of September, Labor Day in the USA. Temperatures on the order of -11° C (12° F), which I think is the coldest of the trip, so far. It has been sunny and clear for about 18 hours. Good for working and spirits, but still cold.

1. About 8:05, S-band reported 3 DSP errors overnight. Ceilometer running okay. MMCR shows no errors, no echoes either. It is clear, sunny and cold out. 449 shows no errors. It is

cold, thermistors show -11.2°C .

2. 449 low mode height coverage dropped to about 2 km last night, but is observing to 3 km now. High mode not seeing much higher. There is interference on some of the winds from last night (0400 and 0500). I don't know what the interference is, but it may be hurting the high mode today. An analysis of the noise in the high mode, as shown earlier in the report for the low mode, shows there may be a 1 dB increase in the noise for part of day 244 into day 245. These noise sources are hard to identify, but should be located in this radar for future work.
3. At the end of the 8:27:52 record, I held the S-band radar. I unplugged the I/F and RX units. I ran the 449 through each mode with the S-band off. At 8:36:29, I restarted the S-Band, and then the 449. If the S-band is the source, I may have cooled off the oscillator, so that if it is the problem, it may not reappear.
4. From 8:50 to 9:06 I was working in the container to tie down the 449. I discovered a loose connection from the amplifier to the circulator. It caused the amp to shut down. I double checked all the RF connections and now it is okay.
5. About 10:30 I found that the compressor output has been closed most of the trip. It didn't pressurize, so there must be leaks. Further reading of the instructions shows that I have connected the compressor wrong, hooking the antenna to the inlet, not outlet of the compressor. Hooking it up properly, the antenna now pressurizes with dry air. Since the output of the compressor has been off, the antennas have not been pressurized for most of the trip.
6. From 12:30 to 12:35, the monthly calibration ran on the MMCR. No errors, according to LapXM. I used the IDL program to look at the CalTable. Somehow I got the program to ask to write the file and I did, which messed it up. I replaced the CalTable.nc file with the other version written today.
7. About 12:06, on the MMCR-DM computer the Radar Monitor is stopped and nothing was changing. I shut down the Radar Monitor and restarted it running. I don't know how long it was stopped. There were Windows delayed write and improper disconnect messages on the screen. I don't know if they can cause Radar Monitor to stop. I was lucky, as if the Radar Monitor is not running for the calibration, LapXM will fail and there will be a lot of errors. I think that the Radar Monitor should be a tighter part of LapXM, and reside on the same computer. Having it on a separate computer, and separate software creates a higher risk of failure than I think is necessary in modern radars.
8. I have spent most of the day tightening and tying things down. Matt spent the day on the ice floe helping tear down the met alley. I think the equipment is ready to move, which we are to start doing tonight.
9. In the afternoon, Thomas, one of the first officers, called me to check to see if it would be okay for him to turn on the ship's radar. He was concerned about interference. I assured him that he had priority and should turn on. I did appreciate the call. The crew of the Oden has been very good to work with, understanding that the mission is science. I don't think the ship's radars interfere with our radars, other than creating rotating scatters on the superstructure.
10. About 17:05, the S-band transmitter currents are 243 mA and 1140 mA. The 449 currents are 9.7 A and 7.8 A. The 449 antenna splitter thermistor temperatures were measured:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	-5.60	2.18	-7.91	0
J2	-6.72	1.06	-7.80	0.11
J3	-6.87	0.91	-6.86	1.05
J4	-7.78	0	-7.75	0.16
J5	-6.67	1.11	-7.84	0.07
J6	-7.76	0.02	-7.70	0.21

36. Tuesday, 2 September 2008, day 246. This is the first day of our trip home. We started with a celebration on the helipad at midnight. After toasts and congratulations, I check the equipment. The day ended with a traditional Swedish crayfish party.

1. About 00:50, we are underway. The ship is heeling $\pm 4^\circ$, or more. Everything in the container appears to be riding well. I'm off to bed.
2. About 10:45, after 8+ hours of sleep, I'm back to work. S-band reported 3 more DSP errors. The ceilometer is running okay. MMCR reports no errors. MWR is running. 449 report no errors.
3. We have moved into/under clouds. The MMCR sees them to about 600 m. The 449 looks like clear air.
4. About 10:50, we are at 86.87N, 1.6W. Speed over Ground (SOG) is 3 m/s. I'm glad we are using Dave Carter's software on the MMCR. It records GPS SOG and COG (Course over Ground), as well as latitude and longitude. This will be helpful in doing the motion compensation for the radars, especially the 449.
5. The 449 compressor has pressurized the system and is holding pressure. It clicks on every 5 seconds or so, but only briefly.
6. Starting with record 11:04:03, we started running ASCOS_449_V11TS.cfg on the 449. This configuration file uses 5 beams and saves the time series. This will allow development of good motion removal algorithms.
7. At 12:30 the daily calibration check ran on the MMCR, with no problems.
8. In the afternoon, the different labs and groups had an open house for anyone on the ship. We had several visitors.
9. About 17:29, the S-band transmitter currents were 250 and 1160 mA. The 449 transmitter currents was 9.5 A in the high mode. I held the 449 to measure the temperature of the six-way splitter in the BSU:

Thermistor	North Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	-0.28	2.83	-0.87	2.63
J2	-1.56	1.55	-2.11	1.39
J3	-1.84	1.27	-1.89	1.61
J4	-3.11	0	-3.50	0

J5	-2.58	0.53	-3.35	0.15
J6	-2.84	0.27	-3.28	0.22

37. Wednesday, 3 September 2008, day 247. Ice breaking today. The ride has not been too bad, but there have been a few big jolts and vibrations. Matt and I slept in after the crayfish party last night.

1. About 13:00, the S-band showed one DSP error overnight. The 449, MWR, MMCR, and ceilometer all are running with no errors.
2. The MMCR pitch shows us heeling $\pm 4^\circ$. MWR pitch and roll change, but not very quickly.
3. About 13:20, GPS shows us at 85.8°N , 3.6°E .
4. About 16:50, S-band currents are 255 and 1177 mA. 449 transmitter currents are 9.5A and 7.7A. 449 Radar Monitor shows 929 W. I held the high mode east and south beams to read the splitter temperatures:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	-2.18	2.38	-3.10	1.62
J2	-2.50	2.06	-4.20	0.52
J3	-3.93	0.63	-3.59	1.13
J4	-4.56	0	-4.72	0
J5	-3.79	0.77	-4.68	0.04
J6	-4.27	0.29	-4.59	0.13

38. Thursday, 4 September 2008, day 248. More moving south through the ice today.

1. About 8:20, GPS shows us at 84.6°N , 2.0°E . No errors on all three radars. Ceilometer and MWR running okay.
2. At 9:31:27, 449 reported an error, unable to open time series file. One time series record was lost. I suspect that this was caused by data archiving activities.
3. About 17:00, no errors on any machines. S-band transmitter currents are 261 and 1204 mA. 449 transmitter current is 9.7 A in high mode. I paused the high modes to record the splitter temperatures:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	4.46	2.91	2.41	1.18
J2	1.73	0.18	1.55	0.32
J3	2.74	1.19	1.94	0.71
J4	1.55	0	1.29	0.06
J5	2.04	0.49	1.23	0
J6	3.19	1.64	1.29	0.06

39. Friday, 5 September 2008, day 249. More moving south through the ice. We are a little

ahead of schedule.

1. About 8:15, found door to container had been closed too tight last night. Temperature inside the container was 29° C. Opened door wide to cool it off. S-band had one DSP error last night. MMCR and 449 report no errors. Ceilometer and MMCR are running okay.
2. Just after 12:30, MMCR did daily calibration check with no errors.
3. Just before 1400 we stopped for about two hours to do a CTD cast. This should give us two good hours of 449 winds.
4. About 17:15, S-band transmitter currents are 258 and 1196 mA. 449 high mode transmitter current is 9.8 A. I paused the high modes to get the power splitter temperatures:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	2.37	2.08	0.97	0.74
J2	1.93	1.64	0.41	0.18
J3	1.27	0.98	1.07	0.84
J4	0.32	0.03	0.65	0.42
J5	1.60	1.31	0.23	0
J6	0.29	0	0.36	0.13

5. Note that the spectra from 17:15:27 on 449 have a strange noise band at 5.5 km.
40. Saturday, 6 September 2008, day 250. We spent the night moving through ice. Today we are in the marginal ice zone. We are establishing a station for 12-15 hours. During this time, we will be moving very slowly to keep the ship headed into the wind for sampling.
1. About 8:00, no errors on three radars. MWR and ceilometer also okay.
 2. At 7:59, GPS shows speed of 4.67 m/s, course of 169°. Position was 80.9° N, 9.15° E.
 3. About 10:30, we have stopped moving. We are starting the Marginal Ice Zone Station 2 (MIZ2). We will be slowly moving in the ice for the rest of the day. Moving will be done to keep the ship pointed into the wind so air sampling can be done with non-polluted air.
 4. I spent some time looking at the 449 spectra from day 249 17:15:27 mentioned above. It turns out that the next record (17:17:43) has an even more obvious problem with the noise. Looking in detail at both records, I can see that the problem is an error in the noise level determination. This problem should be fixed, since it can lead to incorrect moments calculations, as well as ugly plots. Figures 6 and 7 show the details of this problem. Figure 6 shows how it is typically seen. In Figure 7, the low noise level in the 7.61 km spectral display is evident. This leads to enhanced SNR for this height that is not real. This is a known problem, and will be fixed in the next version of Lapxm.

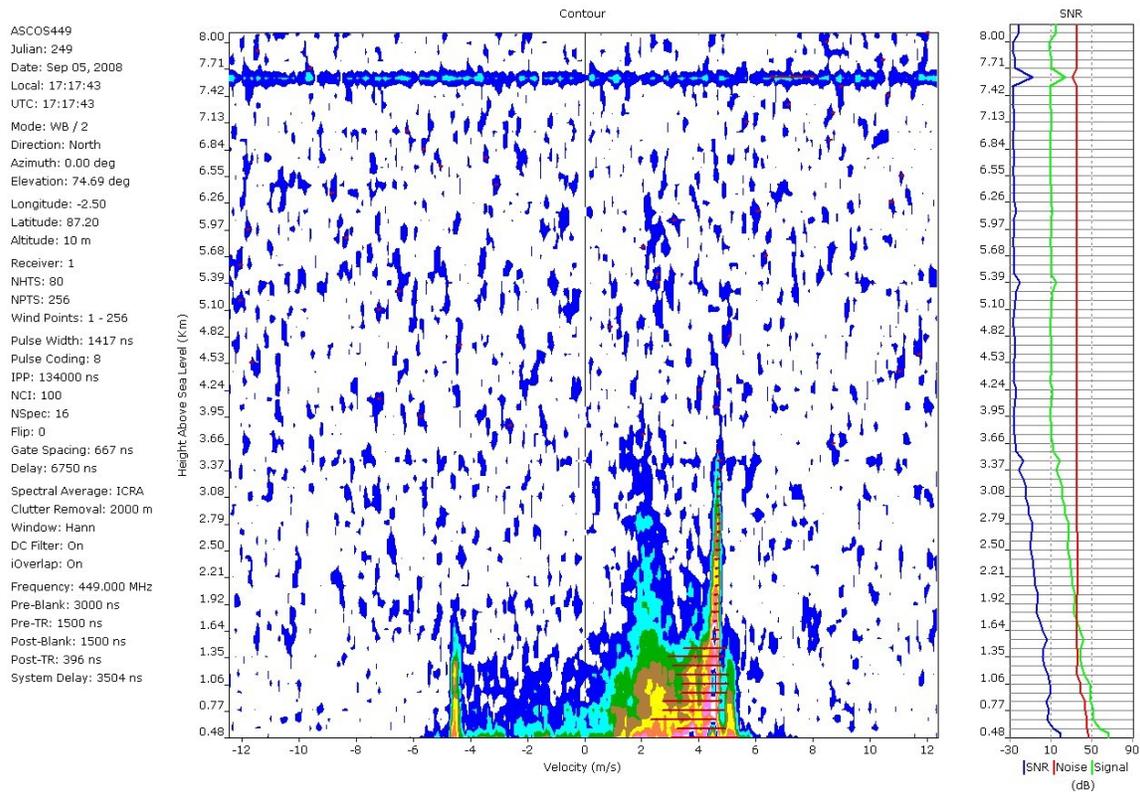


Figure 6. An example of poor noise determination. The stripe near 7.5 km is not a real signal.

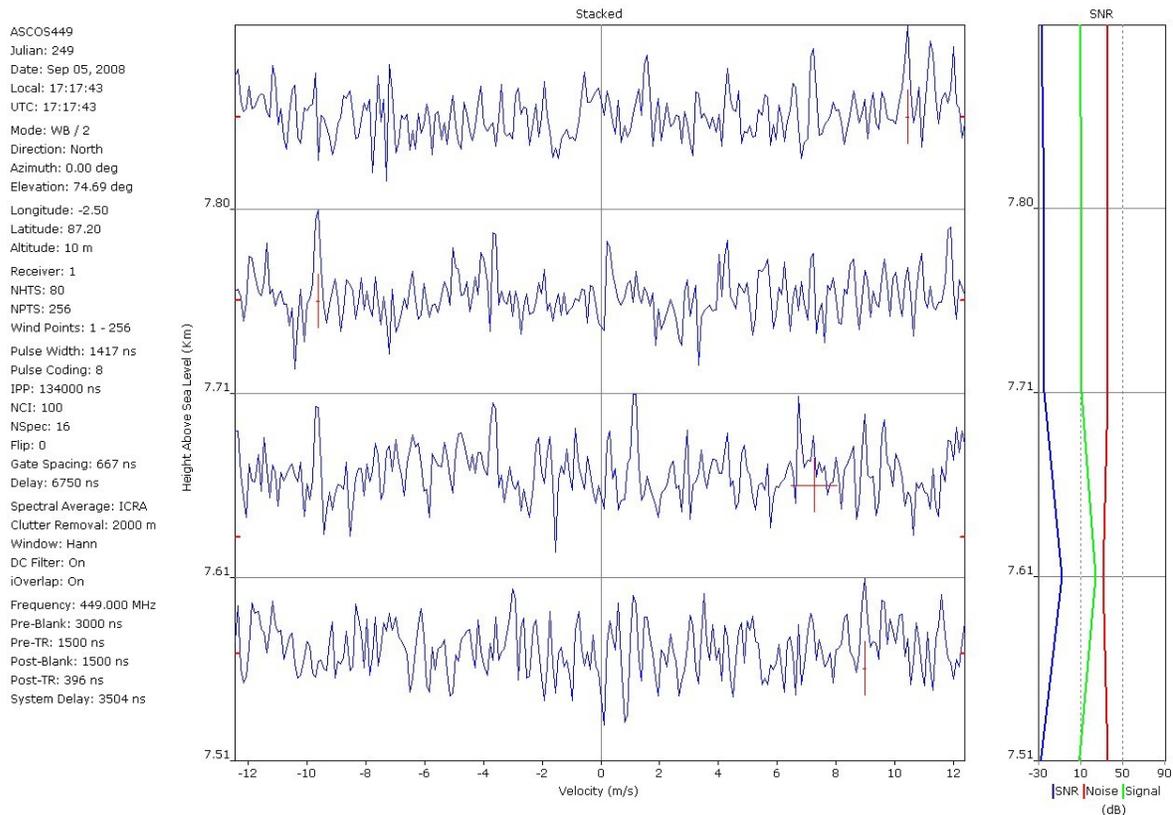


Figure 7. Details of the stripe shown in Figure 6. In the spectra of 7.61 km, the noise level has been determined at too low a level.

- About 17:05, S-band transmitter currents are 259 and 1189 mA. 449 transmitter currents are 9.7 A and 7.9 A. I paused the 449 in the high modes to measure the splitter temperatures:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	0.52	0.72	0.35	0.56
J2	1.65	1.85	-0.10	0.11
J3	0.24	0.44	0.60	0.81
J4	0.24	0.44	0.16	0.37
J5	0.93	1.13	-0.21	0
J6	-0.20	0	-0.09	0.12

- Sunday, 7 September 2008, day 251. We spent the night in MIZ2 until 0400 UT. We also changed ship time from UT to Norwegian/Swedish time, which is 2 hours earlier. At 0400UT, we started an Open Water (OW) station, which will run most of today.
 - About 6:15 UT (8:15 LT), three radars showed no errors. MWR and ceilometer are both running.
 - MWR shows pitch of 0.473, roll of -3.4897. MMCR pitch sensor shows 0.6° for pitch, 0.2° for roll, showing that the ship is very level.

3. About 6:20 UT, GPS shows us at 80.17° N, 10.24° E. SOG is 6.64 m/s, COG is 105°.
4. From 7:30 UT until about 1000 UT we were nearly stationary while a CTD was done.
5. About 15:00 UT, S-band transmitter currents are 256 and 1181 mA. The 449 transmitter currents are 7.8 A and 9.7 A. I paused the 449 in the high modes to measure the splitter temperatures:

Thermistor	South Beam Temperature	Temperature Offset	East Beam Temperature	Temperature Offset
J1	-1.26	0	-0.64	0.5
J2	-0.25	1.01	-1.06	0.08
J3	-1.00	0.26	-0.50	0.64
J4	-0.88	0.38	-0.74	0.4
J5	0.10	1.36	-1.14	0
J6	-1.26	0	-1.00	0.14

42. Monday, 8 September 2008, day 252.

1. About 11:00 UT, all three radars show no errors. Ceilometer and MWR are running okay.
2. MWR pitch and roll both say -0.0027. They have changed since yesterday, but don't change very quickly.
3. At 11:04:58, I changed the 449 to run ASCOS_449_V12TS.cfg. This does not have pulse coding in the 60 meter mode, so there will be possibly better data close to the ship, where the clutter is bad.
4. We will turn the 449 off about 7:00UT and start to take it apart.

This is the end of this log. The voyage will continue, but this document will be placed in the archive.

Examples and discussion of MPP issues

Throughout this document, I have made comments about the Multiple-Peak Picking algorithm not picking the correct peak. Rather than put this information into the text, I am putting it in a section of its own.

On the 449 radar, I collected two types of data. The first type, which is the normal PSD data type, utilizes wavelet transforms on the time series to remove some clutter. The time series then go through spectral transformation and averaging. The average power spectra are then passed through a clutter reduction algorithm (Riddle algorithm), and finally to the MPP process to determine the moments from which the winds are calculated. I will refer to this type of data as MPP data. The second type of data is similar, except the wavelet processing is not utilized. The moments are determined using the classic POP algorithms, which have been pretty constant since the early 1990s. I will refer to these as 'classic' data.

The first example is of a south beam. Here the atmospheric echo is obvious, but MPP has gone off and selected the clutter. I don't understand why this happens, but I would hope that the MPP

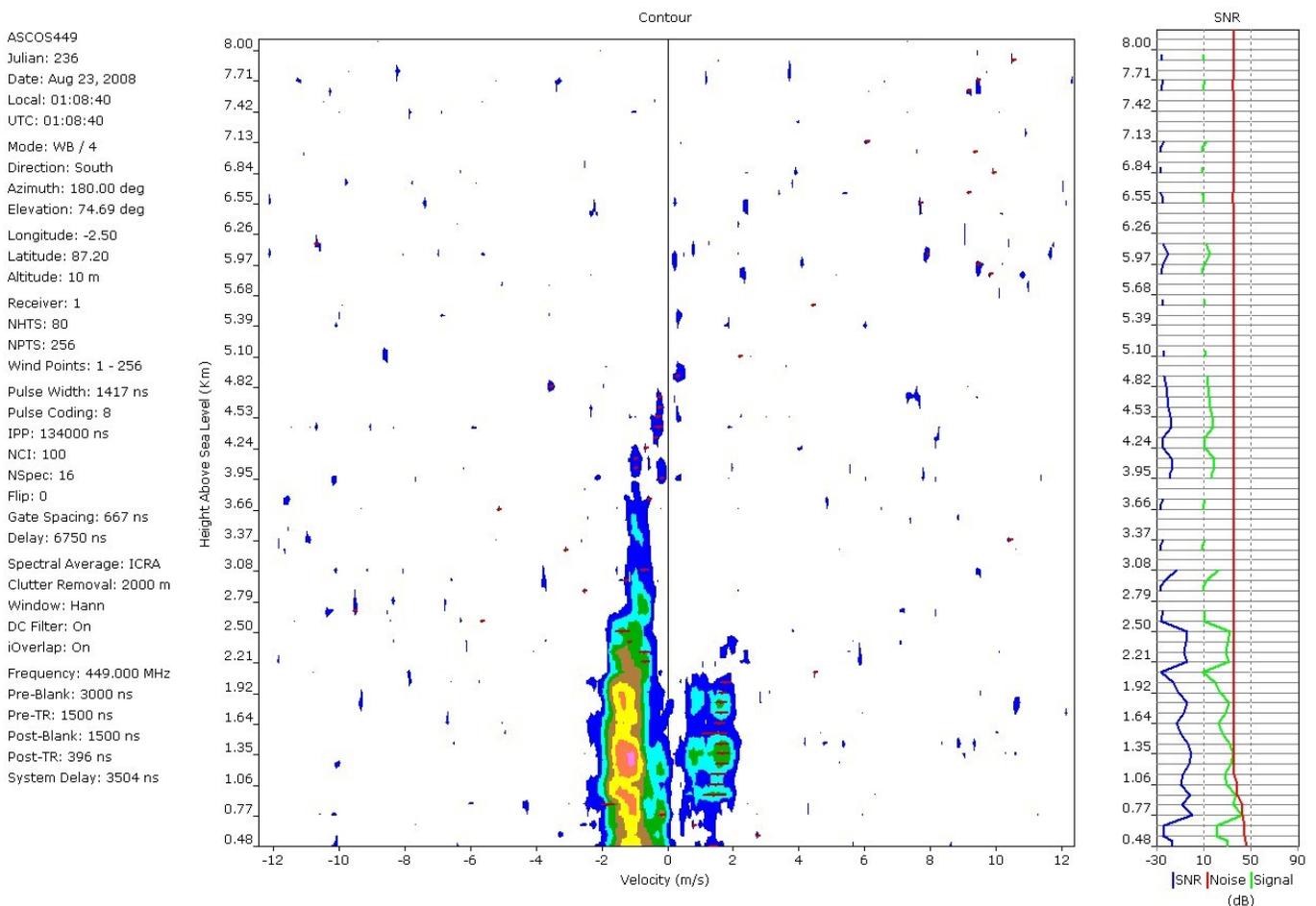


Figure 8.
algorithm would discriminate against clutter, not select it.

The second example shows more detail. The first plot shows the contour plot of the MPP contour data. In this plot, the first contour is 1 dB above the mean noise floor. Each contour shows a 5 dB increment in power. In this case, there is little or no interference or clutter, yet the MPP moments are not placed in the atmospheric echo.

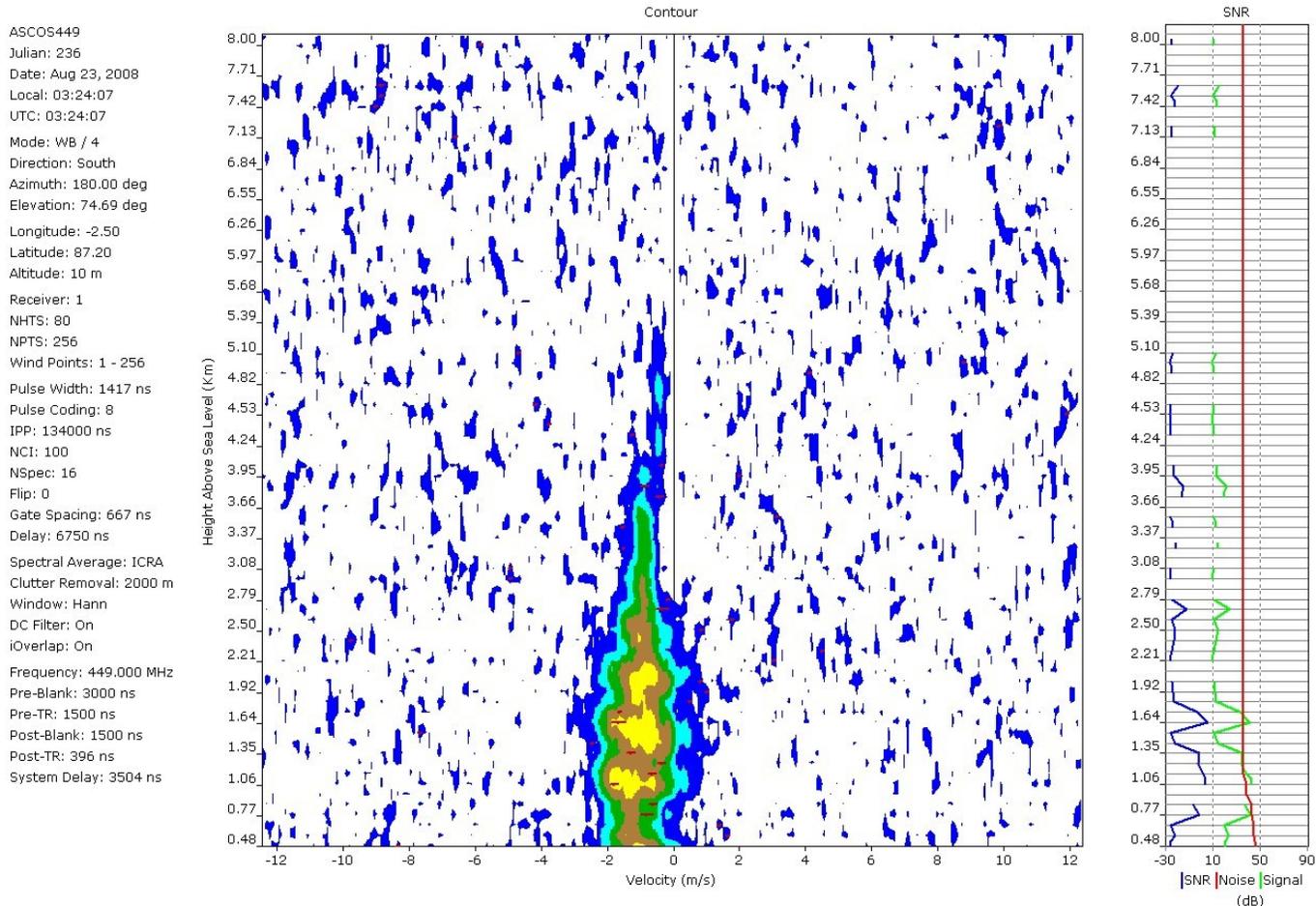


Figure 9.

In the second plot, Figure YY, MPP data is presented in the stacked plot mode, showing the lowest 40 heights. This is the same data presented in the contour plot, Figure XX. In both presentations of the data, at each height there is a red cross showing the calculated radial velocity and spectral width. In Figures XX and YY, the moments are scattered all over the velocity space.

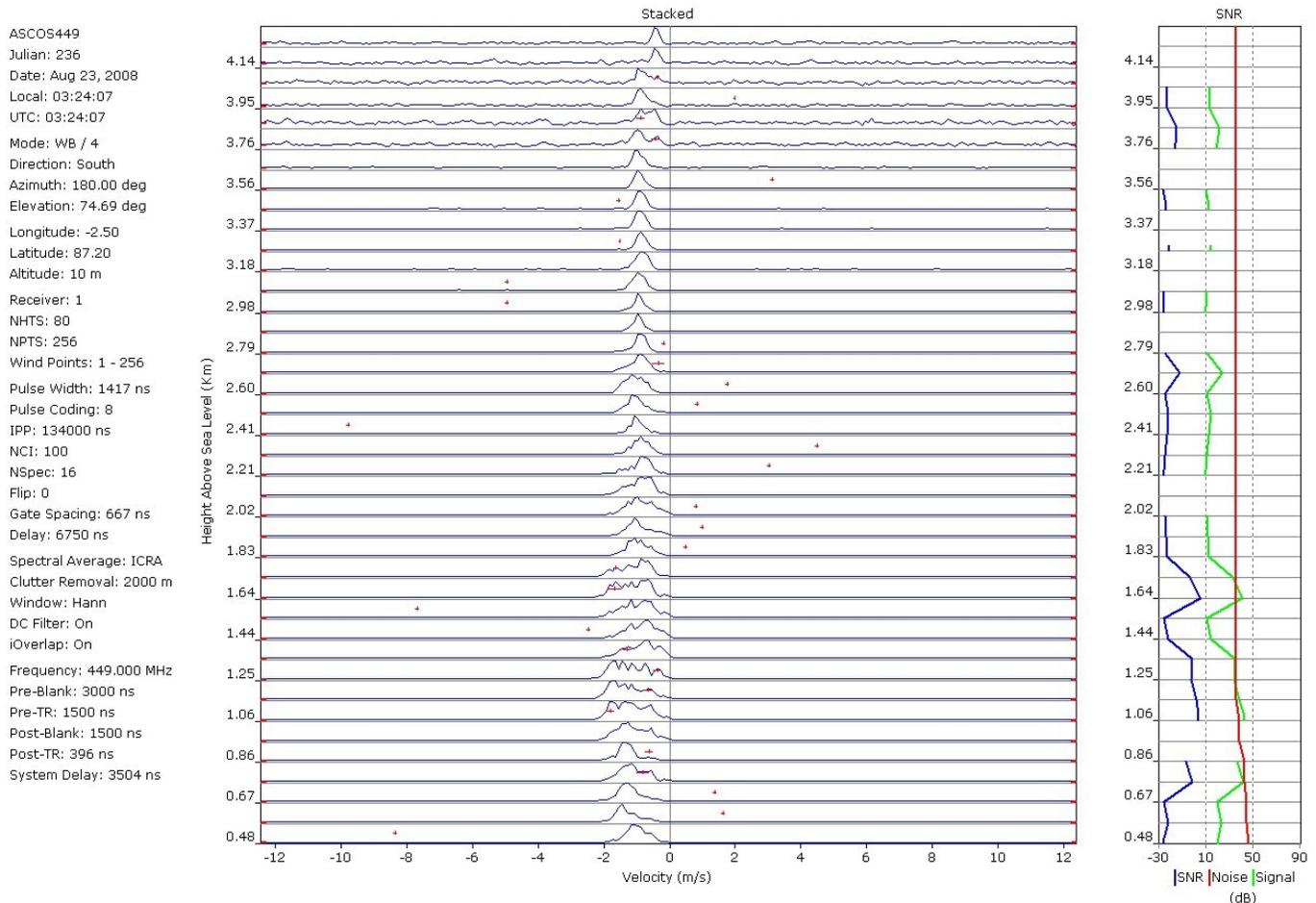


Figure 10.

The final plot is the classic data, in the same stacked spectral plot. Here the moments are placed where one would expect them to be, near the peaks in the spectra.

To be fair, the MPP algorithm did a good job much of the time. There were also times when the classic algorithm failed and selected the incorrect peaks. I have no solution to present, but can see that work will need to be done to reprocess the data to get better moments.

I am not presenting any data in this document, but I did detect differences between the classic spectra and the wavelet spectra. These differences occur mainly in the vertical beam, where the echo is at or near zero. In many cases, I observed that the wavelet spectra had energy removed, especially at or near zero. This means that one must be very careful using the signal power from the 449 to estimate reflectivity. If wavelet processing is used, then energy appears to be removed when the spectra crosses the zero frequency.

ASCOS449
 Julian: 236
 Date: Aug 23, 2008
 Local: 03:24:07
 UTC: 03:24:07
 Mode: WB / 4
 Direction: South
 Azimuth: 180.00 deg
 Elevation: 74.69 deg
 Longitude: -2.50
 Latitude: 87.20
 Altitude: 10 m
 Receiver: 1
 NHTS: 80
 NPTS: 256
 Wind Points: 1 - 256
 Pulse Width: 1417 ns
 Pulse Coding: 8
 IPP: 134000 ns
 NCI: 100
 NSpec: 16
 Flip: 0
 Gate Spacing: 667 ns
 Delay: 6750 ns
 Spectral Average: ICRA
 Clutter Removal: 2000 m
 Window: Hann
 DC Filter: On
 iOverlap: On
 Frequency: 449.000 MHz
 Pre-Blank: 3000 ns
 Pre-TR: 1500 ns
 Post-Blank: 1500 ns

[▲ Scroll Parameters ▼](#)

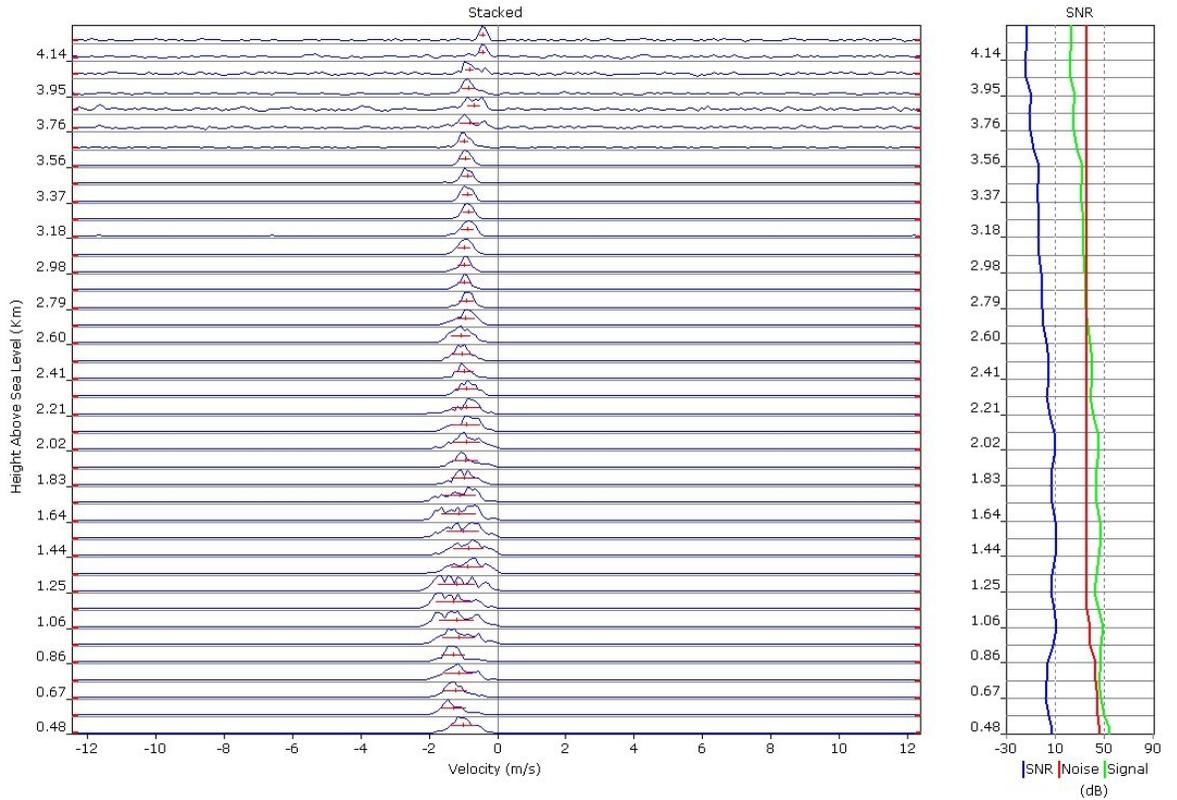


Figure 11.